REMARKS

Applicant respectfully requests reconsideration and further examination of the patent application under 37 C.F.R. § 1.111.

Response to Objection of Drawings:

The drawings were objected to under 37 CFR 1.83(a). The Action states Figure 7 shows an impulse radio receiver but does not show the sampling circuitry, plurality of rake teeth, and the figure of merit determination circuitry recited in claim 19 and its dependent claims. First it should be noted that Figure 7 is provided as background for UWB technology, which along with Figures 8A-8C describe and illustrate the cross correlation process and the correlation function. The instant application, however, describes the <u>multiple-correlator</u> embodiment of the invention starting in paragraph 70 on page 21 stating that multiple correlators and rake correlation techniques can be used to "measure the impulse response of a channel to the maximum communications range of the system and to capture information on data symbol statistics". Examples of such techniques are elaborated upon in US Patent Application No. 09/537,264, which is incorporated by reference in the instant application. Additionally, in paragraph 73 on page 22, the specification describes how a receiver has been developed using a baseband signal converter device having multiple converter (i.e., correlator) circuits and an RF amplifier in a single integrated circuit package. As such, Figure 7 is intended to describe the <u>single correlator</u> impulse radio receiver as a precursor to discussion of advancements in the art including multiple correlator circuits on a single integrated circuit package that would allow rake correlation (i.e., rake receiving) techniques according to the present invention.

The examiner's attention is respectfully directed to Figures 9 and 10 and page 27 starting in paragraphs 164 and 165, where the exemplary multi-correlator embodiment of the present invention is described, as implemented in the Time Domain® PulsON® 200 Chipset. Figure 10

AMENDMENTS TO THE DRAWINGS

Figure 10 is amended as shown in Appendix A. More specifically, the Demodulation Block is amendment to show a block called FOM determination block. As set forth in the Remark section now new matter is introduced by this amendment.

illustrates the transmit and receive data flow of the PulsON® 200 Chipset that includes the sampling circuitry, *multiple correlators corresponding to* the plurality of rake teeth, and the figure of merit determination circuitry of the present invention. As seen in Figure 10 and described in paragraph 167 on page 29, sampling circuitry (denoted Sampler) samples the energy captured by independent/dependent correlator pairs within the two Correlator2 devices, which have output signals denoted by 6. The two Correlator2 devices capture energy when triggered by trigger signals in accordance with frame-offsets corresponding to the anticipated incidence of received UWB pulses. Data is then demodulated by demodulation circuitry according to demodulation techniques specified in configuration registers. Included within the demodulation circuitry is figure of merit (FOM) determination circuitry, which is described in detail as part of the demodulation operation discussion beginning on p. 98 of the specification.

In order to address the Objection, Applicants have amended Figure 10 to denote that the FOM determination circuitry as part of the demodulation circuitry. It is respectfully submitted that this amended is fully supported by the specification and does not involve introduction of any new matter. As described in paragraphs 183 and 184 on page 33, the two Correlator2 devices each have two independent/dependent correlator pairs corresponding to four IQ channels A, B, C, and D, where IQ is well known acronym in the art a meaning "in phase" and "quadrature phase" (i.e., quarter cycle or 90° out of phase). These four IQ channels can be used to sample the received UWB signal at multiple locations within a single frame, where **the locations of these samples are known as rake teeth**. Rake teeth and the optimization of their placement (in time) are described beginning on page 86. Rake tooth placement within placement zones (or regions) is depicted in Figure 54. Thus, in accordance with the invention, Figure 10 depicts Correlator2 devices (or circuitry) that <u>correspond to</u> a plurality of rake teeth. As such, the specification fully supports the impulse radio receiver of claim 19, which comprises two elements, sampling circuitry and figure of merit determination circuitry (as shown with the newly added block in

Figure 10), where the sampling circuitry samples reflections of an impulse radio signal **at** a plurality of rake teeth.

Response to Objection of Abstract:

The abstract was objected to because it referred to purported merits or speculative applications of the invention and does not describe the invention as claimed. Applicants have replaced the abstract of the specification to more clearly describe the invention as claimed.

Response to Objection of Disclosure:

The disclosure was objected to because of informalities including the last sentence on p. 33 being incomplete and on p. 95 the word "fifo" not being "FIFO".

Response to Rejection under 35 U.S.C. 112, first paragraph:

Claims 14-16, 18, 27-29, and 31 were rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. Examiner states that the detailed description does not appear to describe placing and determining time offsets in relation to the energy captured by at least one rake tooth, as recited in claims 14-16 and 27-29.

In reference to Figure 10, paragraph 167 on page 29 describes how frame-offset information corresponding to the anticipated incidence of UWB pulse is sent to a time unit within a Timer2 device, which generates trigger signals that correspond to the frame-offset specified (see items 3 and 4). The trigger signals cause, or otherwise fire, an independent correlator unit followed by a dependent correlator unit with a Correlator2 device to capture energy that is then sampled. (see items 5 and 6). As such, the frame-offset information corresponds to the times the UWB pulse is sampled.

The setting of frame offsets to 'acquire' a UWB pulse is described in paragraphs 232-234, beginning on p.53. This discussion involves "a Scan Engine, [which] is a programmable

microsequencer responsible for adding predetermined time hops to the frame offset." After acquisition is achieved, a signal optimization process is initiated. The signal optimization process is described beginning on p. 86 in relation to Figure 53. It begins with a fine lock process during which "one Timer is used to maintain lock, [and] the remaining three scan an area about the lock point. As each Timer scans a region, Signal Optimization observes the scan and saves the location in the region that the most energy was found. Signal Optimization measures the energy at a point by summing the squares of the ramp built at that point. At the completion of the scan, Signal Optimization restores the 'best' from each region to its corresponding active context. The Scan Engine Timers are then moved to the nearest zero crossing. This new 'zero offset' location is then saved to the corresponding Timer's context location zero. If one of the scan points best value is better than the acquire lock point, Signal Optimization activates the loop corresponding to the new best Timer. The freshly activated loop is allowed to settle for a configurable number of ramps prior to returning control of the radio to the Master Sequencer."

After fine lock is achieved, the signal optimization process is again employed to configure the radio in rake mode. As described on pp. 86-87, a rake receiver "attempts to increases the SNR [i.e., signal-to-noise ratio] by sampling a pulse at multiple locations within a single frame". The objective of the signal optimization process is clearly described on p. 87 as "When placing rake teeth on different reflections received at the multiple locations, it is desired that the teeth be <u>placed on the strongest reflections</u>." An aspect of the present invention is then described where "programmable search zones are used to reduce rake training time. More specifically, parallel running correlators are used to search each zone concurrently to <u>find the best placement spot in each zone</u>." As such, one skilled in the art will clearly recognize that programmable search zones are scanned by varying the frame offset times so as to find the best times to place (or position) the rake teeth such that the maximum energy capture is achieved. In other words, the placement zones are scanned to determine the best lock points for the multiple correlators on the largest reflections (i.e., lobes) so as to achieve the best SNR.

Examiner further states that the detailed description does not appear to describe determining an approximation of the variance of the samples as recited in claims 18 and 31, respectively. Examiner notes that page 102 provides an equation for determining the variance but the disclosure does not describe determining an approximation of the variance. Applicants respectfully disagree. The equation on page 102 is actually an approximation of a variance. As is well know in the art, the correct equation for calculating a variance is:

$$\text{Variance} = \Sigma(\text{sample}^2)/(N-1) - (\Sigma\text{sample}/(N-1))^2$$

However, to simplify the variance calculation, in particular as implemented in digital circuitry, it is well known in the art to simplify the variance equation such that the calculation of N-1 is replaced by the use of N. As such, the specification describes use of variances and provides an example on page 102 of an equation for calculating an approximation of the variance.

Response to Rejection under 35 U.S.C. 112, second paragraph:

Claims 12-16 and 25-29 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Examiner states that, with regards to claims 12, 13, 25, and 26, it is unclear what is meant by confining the time offset of a least one rake tooth to a corresponding placement zone as recited in claims 12 and 25. Applicants respectfully traverse the rejection but have amended claims 12, 13, 25, and 26 such that a 'corresponding placement zone' has been changed to 'corresponding rake tooth placement zone' to more clearly define the invention. As described on p. 87 and depicted in Figure 54 of the specification, one aspect of the invention involves scanning of rake tooth placement zones (or regions) to determine the optimal rake tooth placement (i.e., optimal time offset) within each zone that results in the best SNR. As described, the start of the rake tooth placement zones (or regions) is specified relative to the

acquisition lock point and each zone has a corresponding length (in time). The scanning (or sampling) within the placement zone is specified by parameters that include the integration count (dwell count) and granularity of the search (i.e., time offset step size). In particular, each rake tooth placement zone has programmable boundaries within which the scanning occurs, where the programmable boundaries are determined by a zoning algorithm based on multipath environment and link distances encountered. Programmable zone boundaries also allow for "dynamic dimensioning (or re-diminishing) of a particular zone". In other words, rake tooth placement zone boundaries can be varied on a pulse-by-pulse basis in accordance with zoning algorithm. An example of the zoning algorithm dynamically updating the zone boundaries based on a "fussiness factor" is provided on p. 87. Dynamic rake demodulation is further described on pp. 101-103.

Examiner states that, with regard to claims 19-31, it is unclear how the plurality of rake teeth in claim 19, lines 2-3 relates to the sampling circuitry in claim 19, line 2. As described above, the plurality of rake teeth corresponds to the **locations** (in time) of the plurality of samples made by the sampling circuitry of the received UWB signal. As such, the plurality of rake teeth correspond to a plurality of time offsets within a plurality of corresponding rake tooth placement zones.

Response to Rejection under 35 U.S.C. 102(b):

Claims 6-11, 19-24, 32, and 33 were rejected under 35 U.S.C. 102(b) as being anticipated by Ono (US Patent No. 6,157,687). Applicants respectfully submit that independent Claims 6, 19, and 32 as amended are patentable over Ono.

Ono describes a Rake receiving system that selectively allows fingers to participate in the Rake reception. Ono describes periodically measuring a working quality of each finger by "determining a ratio of electric power between an expected receiving signal and a non-expected receiving signal calculated on the basis of a pilot symbol" (Col. 3, Lines 57-65; Col. 4, Lines 32-

39). (Emphasis Added) In particular, the SIR of Ono is a "ratio between the electric power of an expected receiving signal and the electric power of non-expected receiving signal" (Col. 2, Lined 62-64; Col. 5, Lines 30-41). (Emphasis added)

It is respectfully submitted that like Ono, the claimed invention does not rely on an expected received signal characteristic. In fact, the instant application clearly distinguished this feature of the invention from conventional approaches like Ono. In p. 101, starting from second full paragraph of the section entitled ***Dynamic Rake Demodulatio,*** is stated that conventional approaches use a weighting factor for each rake. According to the last sentence of the paragraph, "[t]he weighting factor for each rake tooth corresponds to an expected amplitude of reflections received by a particular tooth, as determined during a time consuming rake training period."

While the present invention uses a rake training period, rake selection based on FOM does not take place during the conventional rake training period. Rather, according to the present invention, a highly responsive dynamic rake process is implemented that lessens the need for rake training. (See the last paragraph of p. 101) Consequently, the FOM is determined dynamically without considering any impulse radio characteristic, e.g., amplitude, during the rake training period or sequence. As stated in p. 102, first full paragraph, "the dynamic qualification (and disqualification) of rake teeth on instantaneous sample variances results in a highly responsive rake receiver having a significantly reduced requirement for rake training after signal acquisition."

It is respectfully submitted that no such arrangement is disclosed by Ono. This is because Ono uses a pilot symbol known to the transmitter and receiver to periodically measure working quality of each finger. In contrast, the figure-of-merit of the present invention is determined without the impulse radio (or impulse radio receiver) knowing the data (or symbol) being conveyed. More specifically, the present invention determines the quality of the fingers without considering any expected characteristic of the received impulse radio signal as determined during a training/pilot period or sequence.

In order to more clearly focus on the inventive feature of the claimed invention, Applicants have amended independent Claims 6, 19, and 32 to qualify the claims by language that requires dynamically determining figures of merits based upon plurality of reflection samples without considering an expected impulse radio signal characteristic determined during a rake training period. It is believed that this limitation in independent Claims 6, 19, and 32 clearly distinguishes the claimed invention from Ono.

Response to Rejection under 35 U.S.C. 103(a):

Claims 17, 18, 30, and 31 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ono as applied to claims 6 and 19, respectively, above, and further in view of Saints (US Patent No. 5,903,554). Applicants have amended independent Claims 6 and 19 to contain the additional limitation as described above. Claims 17, 18 depend on claim 6 and claims 30, and 31 depend upon claim 19. Applicants have argued above that Ono uses a pilot symbol. Saints also teaches using a pilot signal rake teeth selection. Specifically, Saints teaches two embodiments he describes as the Pilot Fraction Method (Col. 4, Lines 20-59) and the Pilot Scatter Method (Col. 5, Lines 60-65), respectively. As such, both Ono and Saints use an expected signal characteristic of a pilot signal (e.g. amplitude) for rake teeth selection, whereas the present invention does not use an expected impulse radio signal characteristic determined during a rake training period, as required by the amended claims.

Conclusion:

Applicants respectfully submit that in view of the foregoing, all of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Therefore, the Applicants respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn.

If the Examiner believes, for any reasons, that further communication will expedite prosecution of this application the Examiner is invited to telephone the undersigned at the number provided.

Accordingly, in view of the above amendments, it is believed that the remaining claims of the present invention are in condition for allowance.

Respectfully submitted,

Date: 5/13/05

Robert S. Babayi
Registration No. 33,471
VENABLE
P.O. Box 34385
Washington, D.C. 20043-9998
Telephone: (202) 344-4800
Telefax : (202) 344-8300

RSB/klm
::ODMA\PCDOCS\DC2DOCS1\648353\1